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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/037,897	10/22/2001	Yijun Cai	019717-002200US	6855

7590 04/07/2005

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EXAMINER	
JAMAL, ALEXANDER	
ART UNIT	PAPER NUMBER
2643	

DATE MAILED: 04/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/037,897	Applicant(s) CAI, YIJUN	
	Examiner Alexander Jamal	Art Unit 2643	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 October 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-34* is/are rejected.

7)☒ Claim(s) *28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *9-22-2003*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. **Claim 28** objected to because of the following informalities:

As per **claim 28,** line 3, 'ration' should be 'ratio'.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. **Claims 1,7,15,26,30, 4,6,12,14,19,21, 5,13,20,8,22,27-29** rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (Applicant's specification 'Background section' pages 2-3), and further in view of Chang et al. (IEEE article 'Analysis of Oscillators with external feedback loop for improved locking range and noise reduction' pages 1535-1541).

As per **claim 1,** applicant's background section discloses a known problem of crosstalk between two VCO's on the same integrated substrate due to injection-locking between the two circuits (specification pages 1-2). However, applicant's background does not disclose a solution comprising a method to reduce the injected crosstalk between

the VCOs. The method comprises measuring the injection-lock frequency range of the VCO circuits by applying a control voltage to the first VCO to cause injection lock with the second VCO, then sweeping the frequency of the second VCO to determine the locking range of the circuits.

Chang discloses the fundamental properties of VCO's using phase-lock-loops regarding the injection locking range of a VCO. Chang discloses that the gain and bandwidth of the loop can be used to set the locking and capture ranges of the circuit (page 1535 Col 1 last paragraph to Col. 2). Chang further teaches that the VCO will lock to a signal when the conditions of Equation 3 (Page 1536 Col 1 last two paragraphs to Col 2 first 2 paragraphs) which is based off the free-running frequency of VCO. Chang further discloses the injection locked VCO will comprise a locking range, and this locking range may be measured in the free-running mode (no feedback) and the results used to determine all the parameters of the system model (page 1537 Col 1 first 3 paragraphs). Chang measures the locking range by injecting a frequency-sweeping signal into the VCO and uses the results to verify the models. It would have been obvious to one of ordinary skill in the art at the time of this application that the crosstalk problem disclosed by applicant's background section could be solved by implementing Chang's teachings to measure an injection-lock range (tuning range) between the two VCOs by injection locking one VCO (first VCO) to the source of crosstalk (the second VCO), and then sweeping the frequency of the injected signal (from the second VCO) for the advantage of being able to modify the gain/bandwidth of the loop so that one VCO does not injection-lock to the other VCO causing crosstalk (ie. essentially measure one

parameter to solve the equations presented by Chang in order to calculate the gain/bandwidth of the loop that will reduce the effects of crosstalk).

As per **claim 7,** claim rejected for same reasons as claim 1. Additionally, Chang discloses that the Que factor is related to the injection signal strength (Que factor being determined by the LC tank circuit of Figs. A and B). Chang further discloses an equation (bottom of Col 1 page 1536) that may be re-written as Ainj=(constant)*(injection lock range)*(Q)*(Avco)/Freq_vco, which is analogous to Pinj=(constant)*(injection lock range)^2 * (Q)^2 * Pvco/Freq_vco. It would have been obvious to one of ordinary skill in the art at the time of this application when attempting to compensate for the injected signal based upon a measured locking range to solve all system equations and calculate the injection power for the advantage of knowing when the injected signal level has been compensated for (ie. it's level has been reduced adequately).

As per **claim 15,** claim 15 rejected for same reasons as claims 1 and 7. It would have been obvious to one of ordinary skill in the art at the time of this application to vary (either increase or decrease) the output power of the VCO as per the equation disclosed in the claim 7 rejection for the purpose of reducing the injected signal power (as per said equation).

As per **claim 26,** claim rejected for same reasons as claim 15 rejection. Adjusting the voltage or power level of either VCO will adjust the power ratio between the two VCOs.

As per **claim 30,** claim rejected for same reasons as claim 26.

As per **claims 4,6,12,14,19,21,** the VCOs are part of PLL circuits.

As per **claims 5,13,20,** the swept frequency injection signal is an input stream into the first VCO.

As per **claim 8,** claim rejected for same reasons as claim 1 and 7 rejections.

As per **claim 22,** claim rejected for same reasons as claim 7 rejection. The power of the free running VCO is adjusted by the adjusting the amplitude ('A' term in the equation of the claim 7 rejection).

As per **claim 27-29** claims rejected for same reasons as claim 1,7 rejections. When implementing Chang's teachings, the equation of claim 7 shows that either the bandwidth ratio or power ratio (or both) between the two VCOs must be varied in order to reduce the injected signal strength. When optimizing a first VCO, the injection signal generator is the second VCO.

4. **Claims 2-3,9,10,11,16,18,22-25,29,31-34,** rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art (Applicant's specification 'Background section'

pages 2-3) and Chang et al. (IEEE article 'Analysis of Oscillators with external feedback loop for improved locking range and noise reduction' pages 1535-1541) as applied to claims 1 and 7,15,26,30.

As per **claims 2,9,10,16,17,** applicant's background section and Chang disclose applicant's claims 1,7,15,26,30, but they do not specify switching input to the injection signal source (the second VCO) from a low pass filter output to a control signal.

Applicant's background discloses the first and second VCOs (one being an injection source to the other), and Chang discloses that the injection source is a swept frequency range. It would have been obvious to one of ordinary skill in the art at the time of this application that when using a VCO in a PLL as a swept frequency injection source, the PLL would have to be broken for the purpose of allowing the VCO output frequency to vary. Furthermore, it would have been obvious that a voltage signal (control signal) could be used to control a VCO or Voltage-Controlled-Oscillator based upon the definition of a VCO.

As per **claim 3,11,18,** the frequency of the injected VCO is swept (which inherently comprises a monotonically changing control signal into a voltage-controlled-oscillator).

As per **claims 22-25,** applicant's background section and Chang disclose applicant's claim 15, but they do not disclose increasing the free-running VCO output power by increasing VCO signal amplitude, or lowering VCO load resistance.

Chang teaches the design and analysis of VCO circuits as per the equations mentions in the claim 7 rejection. From those equations it is obvious that the free-running VCO amplitude (and power) are proportional to the injected signal strength. Additionally, the equation of the claim 7 rejection discloses that the injected signal strength is also proportional to the circuit Q (with the Q being dependant upon the values of the loop filter) (Chang, page 1535, Col 1). It would have been obvious to one of ordinary skill in the art at the time of this application that P=V^2/R and that the power could be varied by varying either the voltage amplitude or resistance of the VCO for the advantage of reducing the injected signal power. Furthermore, it would have been obvious that one could vary the circuit Q (as per the equations of the claim 7 rejection) (by changing a loop filter response) for the purpose of reducing the injected signal power as per the equation of the claim 7 rejection.

As per **claims 31-34,** applicant's background section and Chang disclose applicant's claim 30, but they do not specify that the first VCO have a larger power level and a smaller bandwidth than the second VCO.

Chang discloses a design tradeoff in VCO-PLL design with injected signal power being directly proportional to the free running VCO power, loop bandwidth (Q), and injection locking range of a free running VCO as per the equation of the claim 7

rejection. In the case of two intergrated VCO circuits, one circuit becomes the source of the injected signal, so Ainj is also directly proportional to the gain and bandwidth of the injecting VCO. It would have been obvious to one of ordinary skill in the art at the time of this application that when attempting to lower the injected crosstalk between two integrated VCO circuits, each circuit would act as an injection source to the other and in order to minimize the injected signal to each VCO, then one VCO would have to be optimized to reduce one parameter (gain, bandwidth) relative to the other, and the other VCO would have to reduce the other parameter relative to the other for the advantage of being able to minimize the signal injected to one VCO without increasing the signal being injected from that VCO to the other VCO (ie. one VCO/PLL has a higher bandwidth and the other VCO/PLL has a higher gain).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander Jamal whose telephone number is 571-272-7498. The examiner can normally be reached on M-F 9AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis A Kuntz can be reached on 571-272-7499. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9315 for After Final communications.

AJ
April 1, 2005

CURTIS KUNTZ
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